

IV. "On Isoprene and Caoutchine." By C. GREVILLE WILLIAMS, Esq. Communicated by Professor STOKES, Sec. R.S.
Received June 4, 1860.

(Abstract.)

This paper contains the results of the investigation of the two principal hydrocarbons produced by destructive distillation of caoutchouc and gutta percha.

Isoprene.

This substance is an exceedingly volatile hydrocarbon, boiling between 37° and 38° C.; after repeated cohobations over sodium, it was distilled and analysed. The numbers obtained as the mean of five analyses were as follows:—

Experiment.		Calculation.	
Carbon . . .	88·0	C ¹⁰ 60	88·2
Hydrogen . . .	12·1	H ⁸ 8	11·8
		68	100·0

Three of the specimens were from caoutchouc and two from gutta percha. The vapour-density was found to be at 58° C. 2·40. Theory requires, for C¹⁰ H⁸=4 volumes, 2·35. The density of the liquid was 0·6823 at 20° C.

Action of Atmospheric Oxygen upon Isoprene.

Isoprene, exposed to the air for some months, thickens and acquires powerful bleaching properties owing to the absorption of ozone. On distilling the ozonized liquid, a violent reaction takes place between the ozone and the hydrocarbon. All the unaltered hydrocarbon distils away, and the contents of the retort suddenly solidify to a pure, white, amorphous mass, yielding the annexed result on combustion:—

Experiment.		Calculation.	
Carbon . . .	78·8	C ¹⁰ 60	78·95
Hydrogen . . .	10·7	H ⁸ 8	10·52
Oxygen . . .	10·5	O 8	10·53
		76	100·00

This directly-formed oxide of a hydrocarbon is unique, as regards both its formula and mode of production.

Caoutchine.

Himly's analysis was correct. The mean results of three analyses are compared in the following Table with those of M. Himly :—

	Mean.	Himly.	Calculation.		
Carbon . .	88.1	88.44	C ²⁰	120	88.2
Hydrogen .	11.9	11.56	H ¹⁶	16	11.8
				<hr/> 136	<hr/> 100.0

Two of the determinations, the results of which are incorporated in the above mean, were made on a substance from gutta percha. The vapour-density was :—

Experiment.	Himly.	Calculation = 4 vols.
4.65	4.46	4.6986

We now for the first time see the relation between the two hydrocarbons. It is the same as between amylene and paramylene. The author discusses the boiling-point of these bodies, and shows that they form most decided exceptions to Kopp's empirical law.

Action of Bromine on Caoutchine and its isomer Turpentine.

Caoutchine and turpentine act on bromine in precisely the same manner. One equivalent of the hydrocarbon decolorizes four equivalents of bromine. To determine this point quantitatively, eight experiments were made, four with turpentine and four with caoutchine. The quantity of bromine-water employed was 20 cub. cents. = 0.2527 gramme bromine.

Mean of four turpentine experiments.	Mean of four caoutchine experiments.
0.1074 gm.	0.1091 gm.

Conversion of Turpentine and Caoutchine into Cymole.

By the alternate action of bromine and sodium on caoutchine or turpentine, two equivalents of hydrogen are removed, the final result being cymole, having exactly the odour hitherto considered characteristic of the hydrocarbon obtained from oil of cumín, and quite distinct from that of camphogene. The liquid was identified by the annexed analyses. No. I. was from turpentine, II. and III. from caoutchine.

	Experiment.			Mean.	Calculation.		
	I.	II.	III.				
Carbon . .	89.2	89.5	89.5	89.4	C ²⁰	120	89.6
Hydrogen . .	10.5	10.4	10.4	10.4	H ¹⁴	14	10.4
						<hr/> 134	<hr/> 100.0

Agreeing perfectly with the formula C²⁰ H¹⁴ *.

Paracymole.

At the same time that cymole is formed, there is a production of an oil having the same composition, but boiling about 300° C. The author has provisionally named it paracymole.

Action of Sulphuric Acid on Caoutchine.

Sulphuric acid acts on caoutchine, converting it almost entirely into a viscid fluid like hévéène, at the same time a very small quantity of a conjugate acid is formed, having the formula



the composition was determined from that of the lime salt, which on ignition, &c., gave a quantity of sulphate of lime equal to 8.3 per cent. of calcium; C²⁰ H¹⁵ Ca S² O⁶ requires 8.5.

The author considers the action of heat on caoutchouc to be merely the disruption of a polymeric body into substances having a simple relation to the parent hydrocarbon. He deduces this view from the similarity in composition between pure caoutchouc, isoprene, and caoutchine.

The following Table contains the principal physical properties of isoprene and caoutchine :—

Table of the Physical Properties of Isoprene and Caoutchine.

Name.	Formula.	Boiling-point.	Specific gravity.	Vapour-density.	
				Expt.	Calculated.
Isoprene	C ¹⁰ H ⁸	37°	0.6823 at 20°	2.44	2.349
Caoutchine	C ²⁰ H ¹⁶	171°	0.8420	4.65	4.699

In the calculations rendered necessary by the numerous vapour-

* (Note received July 27.) Both the cymole from turpentine and that from caoutchine were converted into insolinic acid by bichromate of potash and sulphuric acid. The quantitative determinations made on the silver salt of the acid were almost theoretically exact.

density determinations contained in this paper, and more especially in those "On some of the products of the Destructive Distillation of Boghead Coal," the author has so repeatedly had to ascertain the value of the expression $\frac{1}{1+0.00367T}$, that he was induced to calculate it once for all for each degree of the Centigrade thermometer from 1° to 150° . As it is always easy so to manipulate as to prevent the value of T falling between the whole numbers, the Table proved a most valuable means of saving time; the author has therefore appended it to his paper in the hope of its proving equally useful to other working chemists.

- V. "On the Thermal Effects of Fluids in Motion—Temperature of Bodies moving in Air." By J. P. JOULE, LL.D., F.R.S., and Professor W. THOMSON, LL.D., F.R.S.
Received June 21, 1860.

(Abstract.)

An abstract of a great part of the present paper has appeared in the 'Proceedings,' vol. viii. p. 556. To the experiments then adduced a large number have since been added, which have been made by whirling thermometers and thermo-electric junctions in the air. The result shows that at high velocities the thermal effect is proportional to the square of the velocity, the rise of temperature of the whirled body being evidently that due to the communication of the velocity to a constantly renewed film of air. With very small velocities of bodies of large surface, the thermal effect was very greatly increased by that kind of fluid friction the effect of which on the motion of pendulums has been investigated by Professor Stokes.

- VI. "On the Distribution of Nerves to the Elementary Fibres of Striped Muscle." By LIONEL S. BEALE, M.B., F.R.S., Professor of Physiology and of General and Morbid Anatomy in King's College, London, and Physician to King's College Hospital. Received June 19, 1860.

(Abstract.)

After alluding to the general opinions entertained with respect to